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Research Abstracts

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CURRENT NACA REPORTS

NACA Rept. 1150

CONSIDERATIONS ON THE EFFECT OF WIND-TUNNEL WALLS ON OSCILLATING AIR FORCES FOR TWO-DIMENSIONAL SUBSONIC COMPRESSIBLE FLOW. Harry L. Runyan and Charles E. Watkins. 1953. ii, 7p. diags. (NACA Rept. 1150. Formerly TN 2552)

This paper treats the effect of wind-tunnel walls on the oscillating two-dimensional air forces in a compressible medium. The walls are simulated by the usual method of placing images at appropriate distances above and below the wing. An important result shown is that, for certain conditions of wing frequency, tunnel height, and Mach number, the tunnel and wing may form a resonant system so that the forces on the wing are greatly changed from the condition of no tunnel walls.

NACA Rept. 1162

LIFT DEVELOPED ON UNRESTRAINED RECTANGULAR WINGS ENTERING GUSTS AT SUBSONIC AND SUPERSONIC SPEEDS. Harvard Lomax. 1954. ii, 16p. diags., 5 tabs. (NACA Rept. 1162. Formerly TN 2925)

Lift forces induced by a vertical gust are estimated on the basis of theoretical calculations. The effects of pitching and wing bending are neglected and only wings of rectangular plan form are considered. However, the effects of Mach number (from 0 to 2) and aspect ratio (2 to ∞) are included, and solutions are given by means of which the response to gusts having arbitrary streamwise gradients can be calculated. Results are presented for sharp-edged and triangular gusts and various wing-air density ratios.

NACA TM 1376

EXPERIMENTS ON TAIL-WHEEL SHIMMY. (Experimentelle Untersuchungen über das Spornradflattern). O. Dietz and R. Harling. October 1954. 81p. diags., photos. (NACA TM 1376. Trans. from Zentrale für wissenschaftliches Berichtswesen der Luftfahrtforschung, Berlin, FB 1320)

Model tests on the "running belt" and tests with a full-scale tail wheel were made on a rotating drum as well as on a runway in order to investigate the causes of the undesirable shimmy phenomena frequently occurring on airplane tail wheels, and the means of

avoiding them. The small model (scale 1:10) permitted simulation of the mass, moments of inertia, and fuselage stiffnesses of the airplane and determination of their influence on the shimmy, whereas by means of the larger model with pneumatic tires (scale 1:2) more accurate investigations were made on the tail wheel itself. The results of drum and road tests show good agreement with one another and with the model values. Detailed investigations were made regarding the dependence of the shimmy tendency on trail, rolling speed, load, size of tires, ground friction, and inclination of the swivel axis; furthermore, regarding the influence of devices with restoring effect on the tail wheel, and the friction damping required for prevention of shimmy. Finally observations from slow-motion pictures are reported and conclusions drawn concerning the influence of tire deformation.

NACA TN 3245

CALCULATED SUBSONIC SPAN LOADS AND RESULTING STABILITY DERIVATIVES OF UNSWEPT AND 45° SWEEPBACK TAIL SURFACES IN SIDESLIP AND IN STEADY ROLL. M. J. Queijo and Donald R. Riley. October 1954. 110p. diags., 2 tabs. (NACA TN 3245)

Subsonic span loads have been calculated for a systematic series of unswept and 45° sweptback tail surfaces by the discrete-horseshoe-vortex method. Results are presented as charts of span loads and the resulting contribution to the side-force and rolling derivatives. Geometric variables covered in the investigation included vertical- and horizontal-tail aspect ratios and vertical position and dihedral of the horizontal tail for various tail assemblies in sideslip and steady roll. Also presented is an extensive table of values of sidewash due to a rectangular vortex.

NACA TN 3247

AN EVALUATION OF AN ACCELEROMETER METHOD FOR OBTAINING LANDING-GEAR DRAG LOADS. Jerome G. Theisen and Philip M. Edge, Jr. October 1954. 22p. diags., photos. (NACA TN 3247)

An evaluation is made of applied ground drag loads obtained by means of angular-acceleration measurements on the wheel of a landing gear together with

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vertical-acceleration measurements on the upper and lower masses. The data are obtained during forward-speed landing impacts and drop tests in the Langley impact basin. The results obtained by using this method showed good agreement with values obtained simultaneously from specially constructed dynamometers.

NACA TN 3248

AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE ANISOTROPY OF 3S ALUMINUM-ALLOY SHEET IN THE PLASTIC RANGE. Arthur J. McEvily, Jr. and Philip J. Hughes. October 1954. 45p. diagrs., photos., 4 tabs. (NACA TN 3248)

The results of tension and compression tests on 3S aluminum-alloy sheet are presented together with values of Poisson's ratio in the plastic range. Crystallographic anisotropy was found to be responsible for the variation in Poisson's ratio in the width and thickness directions of specimens aligned at various directions with respect to the rolling direction in the plane of the sheet. X-ray diffraction studies of annealed specimens were made and pole figures showing the type of preferred orientation were drawn. A theoretical analysis was made to account for the observed anisotropy based on the behavior of single crystals and the texture of the sheet. An independent check of the theory is afforded through comparison with experimental data on cubically aligned copper sheet.

NACA TN 3249

THE HYDRODYNAMIC CHARACTERISTICS OF AN ASPECT-RATIO-0.125 MODIFIED RECTANGULAR FLAT PLATE OPERATING NEAR A FREE WATER SURFACE. John A. Ramsen and Victor L. Vaughan, Jr. October 1954. 32p. diagrs. (NACA TN 3249)

Results of an investigation of the hydrodynamic force characteristics of an aspect-ratio-0.125 modified flat plate on a single strut operating near a free water surface are presented. Comparisons between these data and similar data from previous tests on plates having aspect ratios of 1.00 and 0.25 are presented; these comparisons give the effects of aspect ratio on the characteristics. The experimental effects of varying the depth of submersion and angle of attack are shown. The effects of cavitation at the leading edge and of the planing-bubble type of high-angle separation are presented. Comparisons are also presented between the experimental lift for all three aspect ratios at large depths of submersion and several theoretical methods of predicting the lift.

NACA TN 3250

AN EXPERIMENTAL INVESTIGATION OF THE EFFECT OF WHEEL PREROTATION ON LANDING-GEAR DRAG LOADS. Dexter M. Potter. October 1954. 19p. diagrs., photos., tab. (NACA TN 3250)

The effect of prerotation on the wheel spin-up drag loads on a small landing gear during landings has been investigated in the Langley impact basin. The results showed that, at the forward speed of the test (approximately 85 fps), even partial prerotation resulted in a reduction in both the drag load and the vertical load. At very high speeds, however, con-

sideration of the variation of drag load with forward speed as obtained in a previous investigation indicated that large amounts of prerotation must be used in order to assure a reduction in drag load.

NACA TN 3263

LIFT AND MOMENT EQUATIONS FOR OSCILLATING AIRFOILS IN AN INFINITE UNSTAGGERED CASCADE. Alexander Mendelson and Robert W. Carroll. October 1954. 46p. diagrs., 3 tabs. (NACA TN 3263)

Aerodynamic coefficients similar to those of the isolated airfoil are obtained as functions of the cascade geometry and the phasing between successive blades; the phasings considered are zero, 90° , and 180° . These aerodynamic coefficients are plotted for the special case when all the airfoils are vibrating in bending in phase (360° phasing). It is shown that the effect of cascading for this case is to reduce greatly the aerodynamic damping.

NACA TN 3265

VAPORIZATION RATES AND DRAG COEFFICIENTS FOR ISOCTANE SPRAYS IN TURBULENT AIR STREAMS. Robert D. Ingebo. October 1954. 39p. diagrs., photos., 3 tabs. (NACA TN 3265)

Drop-size distribution and drop-velocity data were obtained for isooctane sprays in turbulent air streams using a droplet camera developed at the NACA Lewis laboratory. Experimental spray vaporization rates, based on the mean diameter, correlated single-droplet vaporization rates. An empirical expression was derived for isooctane droplet drag coefficients.

BRITISH REPORTS

N-32700*

Ministry of Supply (Gt. Brit.)
THE APPLICATION OF "REDUX" ADHESIVE TO AIRCRAFT STRUCTURES. April 1954. 157p. diagrs., photos., 37 tabs. (MOS S & TM 5/54)

This report is concerned with the use of Redux as an adhesive in typical aircraft structures. The strength of the Redux joint was tested by means of static and fatigue tests after considering the variables of pretreatment, pressure, and temperature conditions.

N-32702*

Ministry of Supply (Gt. Brit.)
REPORT ON THE TUNGSTEN ARGON-ARC WELDING OF MAGNESIUM-ZIRCONIUM ALLOYS. AN INVESTIGATION INTO THE USE OF MAGNESIUM ZIRCONIUM ALLOYS IN SHEET AND PLATE FORM. April 1954. 103p. diagrs., photos., 21 tabs. (MOS S & TM 6/54)

This report is an investigation as to the suitability of magnesium-zirconium alloys fabricated by argon arc welding for aircraft structures. The strength of these sheet alloy welds was tested by means of compression and tension loads.

N-32751 *

Aeronautical Research Council (Gt.Brit.)
AN EXPERIMENTAL STUDY OF THREE-
DIMENSIONAL HIGH-SPEED AIR CONDITIONS IN A
CASCADE OF AXIAL-FLOW COMPRESSOR BLADES.
K. W. Todd. 1954. 34p. diagrs., photos. (ARC
R & M 2792; ARC 12,711; 12,308)

Detailed investigations have been made by optical and physical methods in a high-speed wind tunnel of the flow characteristics of two compressor cascades. In part 1 a representative high-camber cascade was examined at zero incidence over entry air velocities ranging from low to critical. Traverses were made of discharge angles and wake losses at all heights so that a relation between two- and three-dimensional losses could be obtained. In part 2 the blade and passage design was conditioned by the findings of part 1, with the aim of so modifying the cascade that its efficiency in the critical flow region would be improved.

N-32752 *

Aeronautical Research Council (Gt.Brit.)
A NEW LAW OF SIMILARITY FOR PROFILES,
VALID IN THE TRANSONIC REGION.
K. Oswatitsch. 1954. 12p. diagrs. (ARC
R & M 2715; ARC 10,807. Formerly RAE Tech.
Note Aero 1902)

A new law of similarity is given, valid for slender profiles in mixed transonic flow with negligible viscosity, according to which the cube of the Prandtl factor of any critical Mach number is proportional to the thickness ratio. It is shown that this rule, and that of von Kármán for flow at sonic speed, are valid for shock waves within the range over which the shock loss is proportional to the cube of the pressure rise. Experimental pressure distributions plotted according to this rule show good agreement, except for the position of the shock wave on the surface.

N-32754 *

Aeronautical Research Council (Gt.Brit.)
TREATMENT OF THE STAGNATION POINT IN
ARITHMETICAL METHODS. A. Thom. 1954. 10p.
diagrs., 2 tabs. (ARC R & M 2807. Formerly
ARC 14,118; FM 1577; Oxford Univ., Engineering
Lab. No.53)

In using any of the relaxation techniques near a stagnation point difficulties arise if the variable is $\log 1/q$. This tends to infinity and the difference equation no longer represents adequately the differential equation without special modification. Methods are given whereby larger squares can be used than had been previously practicable. As little

variation as possible has been introduced into the procedure so that if an electronic calculator is used, the alterations to the circuits would be reduced to a minimum.

N-32755 *

Aeronautical Research Council (Gt.Brit.)
VELOCITY DISTRIBUTION ON THIN TAPERED
WINGS WITH FORE-AND-AFT SYMMETRY AND
SPANWISE CONSTANT THICKNESS RATIO AT
ZERO INCIDENCE. S. Neumark and J. Colling-
bourne. 1954. 43p. diagrs., 6 tabs. (ARC
R & M 2858; ARC 14,474. Formerly RAE Aero
2432)

This report is a continuation of three earlier ones by the present authors and contains a theoretical investigation of subsonic flow past thin tapered unswept wings (of full- or cropped-rhombus plan form), at zero angle of attack. The method used is that of linear perturbation in which the wing is replaced by a system of sources and sinks; the required velocity field is then approximately obtained as that of the velocity components, in the plane of the chord lines, given by this source system. The supersonic velocity is then determined by direct integration.

N-32756 *

Aeronautical Research Council (Gt.Brit.)
METHODS OF APPROACHING AN ACCURATE
THREE-DIMENSIONAL POTENTIAL SOLUTION
FOR A WING. H. C. Garner. 1954. 19p. diagrs.,
2 tabs. (ARC R & M 2721. Formerly ARC 11,802;
Perf.489; FM 1293)

Attention is given to some fundamental aspects of the vortex-sheet theory for determining the distribution of lift on a finite wing. The accuracy and limitations of some existing approximate forms of the theory are discussed. With special reference to the labor of computation an iterative approach to an accurate solution is suggested, and the general mathematical expression for the distribution of lift required to give an exact solution for a Vee wing is considered.

N-32830 *

Royal Aircraft Establishment (Gt.Brit.)
TRANSDUCTORS WITH VOLTAGE RE-SET
CONTROL. A. G. Milnes. March 1954. 21p.
diagrs. (RAE Tech.Note EL.67)

Voltage reset transducers have half-cycle delay times but this response is at the expense of very limited amplification. Factors influencing the performance are discussed and a voltage feedback technique is examined. When preamplification is required thermionic triodes, transistors or conventional transducers may be used; but the control voltage and current conditions of a reset circuit may present matching problems. Applications as computing elements, as synchro-coupling units, as lead networks and for multiplication of two voltages are discussed.

N-32832 *

Royal Aircraft Establishment (Gt. Brit.)
HEAT TRANSFER FROM CIRCULAR FINNED
CYLINDERS UNDER NATURAL CONVECTION
CONDITIONS. Mary D. Wright and G. A. French.
March 1954. 17p. diags., 6 tabs. (RAE Tech.
Note EL.68)

An experimental investigation has recently been made into the cooling in free air of cylinders fitted with different sizes and thicknesses of circular fins and with varied fin spacings.

N-32836 *

Royal Aircraft Establishment (Gt. Brit.)
DESIGN OF TRIDAC (A THREE-DIMENSIONAL
SIMULATOR FOR GUIDED MISSILES). PART VI -
MONITORING TECHNIQUES. K. C. Garner. May
1954. 18p. diags., photos. (RAE Tech. Note
GW 318)

Monitoring systems have been developed to detect certain fault conditions in the operation of the majority of the individual components comprising TRIDAC. Voltage variations or failures in the power supplies to the d.c. amplifiers, and abnormal drift voltages which may occur in the d.c. amplifiers are suitably indicated. Monitoring is also provided to detect saturation of the signal output from each of the d.c. amplifiers. The location in the simulator at which any of these faults occur is displayed on a system of warning lights. The basic principles of these, and other associated facilities, considered of importance to fault location and operational procedure, are discussed.

N-32860 *

Aeronautical Research Council (Gt. Brit.)
EXPERIMENTS ON THE FLOW INTO A SWEEP
LEADING-EDGE INTAKE AT ZERO FORWARD
SPEED WITH NOTES ON THE WIDER USES OF A
SLOTTED INTAKE. J. Seddon and W. J. G.
Trebble. 1954. 18p. diags., tab. (ARC
R & M 2909; ARC 13,928. Formerly RAE
Aero 2409)

The flow into a swept intake at zero forward speed (ground running conditions) is shown to be analogous to the flow round a sharp corner in a duct. Tests have been made on a model of a swept-wing leading-edge intake to measure the losses involved. It is found that the distribution inside the duct can be improved by the use of straight guide vanes, alternatively by means of a special intake slot, or further by a combination of both. Guide vanes increase the mean loss, but the intake slot improves (i.e., reduces) this also. The slot would require to be sealed under flight conditions. It is suggested that this form of slotted intake may have wider applications in the future. Using the results of the experiments and an analogy with the slotted wing, conclusions are drawn regarding the main points of design of the intake slot.

N-32862 *

Aeronautical Research Council (Gt. Brit.)
THE ROLLING POWER OF AN ELASTIC SWEEP
WING. E. G. Broadbent. 1954. 19p. diags.,
4 tabs. (ARC R & M 2857; ARC 13,639. Formerly
RAE Structures 85)

An iterative method of solution is given for the problem of loss in rolling power due to wing deformation. The method is applicable at subsonic or supersonic speeds, and compressibility effects are allowed for, provided the variation of the aerodynamic derivatives with Mach number is known. The numerical labor involved in the solution is not great and the accuracy is considerably greater than can be achieved by the semirigid method

N-32866 *

Nat. Gas Turbine Establishment (Gt. Brit.)
A THEORETICAL EXPRESSION FOR POINT-
SOURCE DIFFUSION IN TURBULENT FLOW. A. B.
P. Beeton. March 1954. 18p. diags. (NGTE
R. 152)

A general expression governing the turbulent diffusion of fuel from a point source in a uniform stream is established from theoretical considerations. The distribution at points some distance downstream of the source can then be reduced to a relatively simple equation, which is identical in form with the relation found to hold experimentally for any one section normal to the flow. It indicates a slight modification to the normal empirical law relating distributions at different sections, again confirming the results of experimental work. The general expression enables distributions to be predicted for points as close to the source as may be desired. In comparison with the accurate values obtained by graphical integration of this expression, the approximate equation is found to give better than 1 percent accuracy at all points beyond about 5 mixing lengths downstream of the source.

N-32868 *

Royal Aircraft Establishment (Gt. Brit.)
FREQUENCY TRIPLING OF AN ELECTRIC SUPPLY
BY SATURABLE TRANSFORMER AND TRANS-
DUCTOR TECHNIQUES. F. D. Gill. March 1954.
52p. diags., photos., 2 tabs. (RAE Tech. Note
EL.62)

Known methods of frequency tripling by means of saturable transformers are examined and found to be too sensitive to input voltage variations for some purposes. A transductor technique has been developed which will tolerate substantial input voltage variations (8 percent). The method is sensitive to the value of load impedance, which must be kept reasonably constant. The frequency tripler is found to be suitable as a power supply to a magnetic amplifier. Both the weight and response time of the magnetic amplifier, redesigned for the triple frequency,

are reduced. In a typical example it is shown that the reduction in amplifier weight compensates for the weight of the frequency tripler and the additional power requirements. The principal advantage of the technique is the improvement in amplifier response time by a factor of three.

N-32869*

Royal Aircraft Establishment (Gt.Brit.)
A CUP-TYPE TRANSMITTING ANEMOMETER
WITH IMPROVED RESPONSE TO DECREASING
GUSTS. W. J. G. Cox. July 1954. 28p. diags.,
photo. (RAE Tech.Note Instn. 140)

A cup-type anemometer is described, capable of giving remote indication and recording of air speed. The instrument is self-generating, giving a voltage output which is reasonably proportional to air speed. A damping brake is described which automatically comes into operation only while the speed is decaying, thereby minimizing the inherent free wheel tendency of this type of instrument and improving its follow-up characteristic to winds of decreasing velocity. The transient responses of the braked and free rotor to step function air velocity changes are deduced, and calibration and loading curves for a particular model are given.

N-32870*

Royal Aircraft Establishment (Gt.Brit.)
A RANGE OF 50 C/S TRANSDUCATORS. A. G.
Milnes and W. N. Corn. April 1954. 23p. diags.,
3 tabs. (RAE Tech.Note EL.64)

Design details are given for twelve 50 c/s transducers covering a power range up to 200 VA at the limit of linear response. The cores used are of Mumetal or H.C.R. laminations or Hipersil C-cores and the voltage range is 13, 25, 50, 115, 240 and 420 V (rms). Nondimensional transducer characteristics are obtained from the performance curves of these units and applied in a design example.

N-32871*

Royal Aircraft Establishment (Gt.Brit.)
DEVELOPMENT OF A VERY QUICK ACTING
ELECTRO HYDRAULIC VALVE. F. W. Read.
June 1954. 12p. diags., photo. (RAE Tech.Note
IAP 1030)

A quick acting hydraulic "on-off" valve was required by Aero Department, R.A.E. as part of experimental equipment to limit the stresses in the tail structure of an aircraft fitted with a powered elevator control and a "g" restrictor. In the first place a "Dowty" type valve was modified and an "on-off" cycle was completed in 45 milliseconds at 700 psi. Flight trials, however, indicated that a shorter operating time was necessary and this note describes a new design in which full hydraulic pressure operates the valves to both "close" and "open" position. A notable improvement in operating times, in rig tests at 450 psi, was shown by the valve "closing" or "opening" in 6 to 7 milliseconds.

N-32876*

Aeroplane and Armament Experimental Establishment (Gt.Brit.) AN ANALYSIS OF THE LONGITUDINAL STABILITY AND CONTROL OF A SINGLE ROTOR HELICOPTER. F. O'Hara. July 16, 1954. 25p. diags. (AAEE/Res/280)

The general theory of longitudinal stability and control for a single rotor helicopter is presented in a form similar to that for fixed wing aircraft. It is shown to be possible to establish for the helicopter in forward flight, in the same way as for fixed wing aircraft, stick fixed static and maneuver margins, on which the stability and handling qualities depend to a marked extent. Extension of the theory is required for stick free longitudinal stability and also for rotor wing combinations and tandem rotor helicopters.

N-32877*

Royal Aircraft Establishment (Gt.Brit.)
INTENSITY/TIME CHARACTERISTICS OF THREE
EMITTED WAVEBANDS IN A CAPACITOR DIS-
CHARGE THROUGH XENON. R. L. Aspden. May
1954. 10p. diags., photos. (RAE Tech.Note
Instn.139)

Intensity/time oscillograms, recording the luminous emission obtained when a capacitor is discharged through gas or vapor, conceal any time factor which may be related to specific frequencies or wavebands. The preliminary investigation described herein shows that in the case of a low pressure xenon filled tube, flashed at normal loading, both the time to peak intensity and the pulse duration are functions of frequency. Although the light is a source of continuously varying spectral quality the composite nature of the flash suggests that for a very limited period during discharge the emission may approach blackbody radiation. A method whereby this period may be located and used to obtain the optimum reproduction in color of a high speed transient is outlined. Details are given of the equipment used in the present tests, together with intensity/time curves of three recorded wavebands covering the visible spectrum.

N-32889*

Aeronautical Research Council (Gt.Brit.)
A VARIABLE INDUCTANCE ACCELERATION
TRANSDUCER. H. K. P. Neubert. 1954. 19p.
diags., photos., 2 tabs. (ARC CP 169)

The acceleration transducer described has been designed as a general purpose transducer for the measurement of vibration and the resonance testing of aircraft on the ground and in flight. The two ranges of $\pm 3g$ and $\pm 9g$, with cutoff frequencies at 70 c/sec and 100 c/sec respectively, will cover the most common magnitudes of vibration amplitudes and frequencies in these applications. It is designed for use with a carrier bridge amplifier and galvanometer recorder, providing a frequency range of zero to about 100 c/sec.

N-32890*

Aeronautical Research Council (Gt.Brit.)
THE RAPID, ACCURATE PREDICTION OF
PRESSURE ON NON-LIFTING OGIVAL HEADS OF
ARBITRARY SHAPE, AT SUPERSONIC SPEEDS.
B. W. Bolton-Shaw and H. K. Zienkiewicz, English
Electric Co., Luton. 1954. 58p. diags., 3 tabs.
(ARC CP 154)

Five methods are developed for determining the pressure distribution on an arbitrary, pointed, convex axisymmetric head shape, of which the ordinate and its first three derivatives are everywhere continuous. When the geometric details are specified, the time required to pressure plot a head shape is from 20 minutes to 3 hours. The methods were checked in five trial cases against accurate pressure distribution, obtained by using van Dyke's second order theory, and generally gave very good agreement. The best method to use of the five depends upon head shape and on the speed and accuracy required.

N-32891 *

Aeronautical Research Council (Gt.Brit.)
THE TECHNIQUE OF FLUTTER CALCULATIONS.
H. Templeton. 1954. 65p. diags., 22 tabs.
(ARC CP 172)

This report describes the basic principles on which theoretical flutter analyses are made, and illustrates them by some simple applications. The techniques employed are typical of those in current use in this country. Three appendices give the two-dimensional aerodynamic derivatives for a wing-aileron-tab system, computational details of typical forms of solution, and an illustration of the use of resonance test modes in flutter calculations.

N-32893*

Aeronautical Research Council (Gt.Brit.)
NOTE ON AN APPLICATION OF THE TILTING
PLATE METHOD OF MACH NUMBER VARIATION
FOR WIND TUNNEL TESTS AT LOW SUPERSONIC
SPEEDS. J. Seddon and L. Haverty. 1954. 18p.
diags., photo. (ARC CP 168)

This report describes an application of the method to a study of internal flow problems of side intakes at transonic speeds in a small supersonic tunnel. By arrangements involving the use of three or four tunnel nozzles, a continuous Mach number range from 0.5 to 1.6 is made available, apart from a gap between 0.97 and 1.04. This method is being used in the No. 2, 5-1/2 inch x 5-1/2 inch supersonic tunnel of the R.A.E.

N-32894 *

Aeronautical Research Council (Gt.Brit.)
THE MANUFACTURE OF AEROFOIL MODELS BY
TANGENT PLANE MILLING. R. S. Marriner.
1954. 20p. diags. (ARC CP 166)

The method described in this paper is a milling process followed by a minimum of hand finishing to ensure a smooth blending of the tangential planes. The accuracy achieved in this trial manufacture of a half-delta wing model was generally just within ± 0.001 inch. The geometrical ideas and formulas developed are for a particular type of airfoil model, but the general idea of rotating and tilting a blank under a cutter can be applied to other types.

N-32895 *

Aeronautical Research Council (Gt.Brit.)
SCHLIEREN METHODS FOR OBSERVING HIGH-
SPEED FLOWS. D. W. Holder and R. J. North.
1954. 27p. diags., photos. (ARC CP 167)

This paper discusses the present state of knowledge concerning the use of schlieren and direct-shadow methods for the visualization of high-speed flow, the emphasis being on the use of the methods in wind tunnel experiments. The techniques for observing flows which are two-dimensional or which possess axial symmetry have reached an advanced stage of development, and are satisfactory for most investigations of this kind; recent progress is reviewed. Several methods which may be useful for the study of flow round finite wings and wing-body combinations are described briefly.

N-32896 *

Aeronautical Research Council (Gt.Brit.)
THE THERMODYNAMICS OF FRICTIONAL RE-
SISTED ADIABATIC FLOW OF GASES THROUGH
DUCTS OF CONSTANT AND VARYING CROSS
SECTION. W. R. Thomson. 1954. 44p. diags.
(ARC CP 158)

This report presents an analytical study dealing with the adiabatic flow of gases with frictional losses through ducts of constant and varying cross section. The thermodynamic treatment is along lines published by other workers such as Bailey and Fabri and is essentially one dimensional in character insofar that frictional effects are assumed to be uniformly distributed over the total cross sectional area of flow. With this simplifying assumption, relationships are deduced connecting the pressure, temperature, velocity, and flow area of the gas at any one plane with those at any other plane in a duct.

N-32897 *

Aeronautical Research Council (Gt.Brit.)
UNSTEADY CAVITATING FLOW PAST CURVED
OBSTACLES. L. C. Woods. 1954. 9p. diags.
(ARC CP 149)

The plane incompressible flow past two symmetric curved obstacles, between which is a finite constant pressure cavity, is calculated for the case when the cavity length and pressure are functions of time.

N-32898 *

Aeronautical Research Council (Gt. Brit.)
AN INVESTIGATION INTO THE ROLLING POWER
AND AILERON REVERSAL CHARACTERISTICS OF
SWEEP WINGS. A. V. Coles and R. J. Margetts.
1954. 28p. diags., photo., 3 tabs. (ARC CP 159)

This paper reviews briefly existing theories relating to swept wings and presents the results obtained from a program of tests on flexible swept wings. The wings tested were of constant span, aspect ratio and area and had angles of sweep ranging from 15° sweep-forward to 60° sweepback. The tests were carried out in a low-speed wind-tunnel, compressibility effects being absent. The test results showed that the reversal speeds of wings of the same stiffness increase with both sweepback and sweepforward, the minimum value occurring with a small amount of sweepback. Predictions of reversal speeds based on semirigid theory showed good agreement with experimental results.

N-32899*

Aeronautical Research Council (Gt. Brit.)
THE PERFORMANCE OF A MULTI-ENGINE HELICOPTER FOLLOWING FAILURE OF ONE ENGINE DURING TAKE-OFF OR LANDING. A. L. Oliver.
1954. 15p. diags., tab. (ARC CP 175)

A theoretical analysis has been made considering the type of site proposed for civil operation in built-up areas. The performance of a twin engine helicopter similar to the Bristol 173 appears to be adequate for safe operation, but the handling judgment involved in return landings may make the performance difficult to achieve. A take-off technique allowing climb-away after engine failure at any stage is preferable but this is not possible for the twin engine machine within the space available. It is possible if the twin engines are replaced by four of the same effective total power but only if the turning climb-away is made after engine failure. A helicopter with sufficient performance for a straight climb-away can in general hover with one engine inoperative.

N-32900 *

Aeronautical Research Council (Gt. Brit.)
AERODYNAMIC DERIVATIVES FOR A DELTA WING OSCILLATING IN ELASTIC MODES. D. L. Woodcock. 1954. 33p. diags., 13 tabs. (ARC CP 170)

Aerodynamic derivatives are given for a delta wing of aspect ratio 3 and 90° apex angle oscillating with symmetric elastic modes in incompressible inviscid flow. They have been determined by the lattice method of W. P. Jones, using the values of the downwash calculated by D. E. Lehrian when obtaining aerodynamic derivatives for the same delta wing oscillating in rigid wing modes. Results for several

modes are given both as local derivatives and also as equivalent constant derivatives. Derivatives for other modes can be obtained either from these or from the values of the reciprocal of the downwash matrix, which also are tabulated.

N-33258*

Aeronautical Research Council (Gt. Brit.)
TOWING-TANK TESTS ON A LARGE SIX-ENGINE FLYING BOAT SEAPLANE, TO SPECIFICATION 10/46 (PRINCESS). PART II - PORPOISING STABILITY, SPRAY AND AIR DRAG TESTS, WITH IMPROVED STEP FAIRING, AFTERBODY DESIGN AND AERODYNAMIC MODIFICATIONS. A. G. Smith, D. F. Wright and T. B. Owen. 1954. 32p. diags., photos., 2 tabs. (ARC R & M 2834; ARC 13,964. Formerly RAE Aero 2404)

Tests were made to improve the main-step fairing in order to reduce air drag while retaining satisfactory porpoising stability at high water speeds; to reduce the midplaning porpoising instability found with the hull lines tested in Part I; to test the effect of increased wing and tailplane areas; and to predict more accurately the full-scale performance of the final hull form by representing more closely the anticipated full-scale conditions of lift, slipstream and damping in pitch. The final form evolved is used for the first production aircraft.

MISCELLANEOUS

N-33233

Advisory Group for Aeronautical Research and Development. THE MECHANISM OF CARBON FORMATION. George Porter. (Scheveningen Netherlands Conference - May 3-7, 1954). 16p. diags. (AG13/M9)

This paper gives a more detailed account of the theory of carbon formation in combustion processes which has been briefly stated elsewhere. Other theories are critically reviewed and a summary is given of the experimental data relating to carbon formation which has been obtained by the flash photolysis technique. The mechanism proposed, which is believed to apply to the high temperature pyrolysis of hydrocarbons as well as to diffusion flames, premixed flames, and explosions in closed vessels, is as follows: all hydrocarbons, when pyrolysed under the high temperature conditions prevalent in the above systems, undergo a decomposition which results eventually in the formation of acetylene and hydrogen. Acetylene then forms carbon particles by a simultaneous condensation and dehydrogenation.



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NACA
RESEARCH ABSTRACTS NO. 72**UNPUBLISHED PAPERS**

N-23711*

SOME RESEARCH WORK IN PROGRESS ON TURBO-MACHINES. (Quelques Recherches en Cours sur Turbomachines). E. Matillet. May 1954. 26p. diags., photos. (Trans. from Association Technique Maritime et Aéronautique, 1953)

Experimental studies carried out on a centrifugal compressor and on components of axial-flow compressors are discussed. Test methods, technique, and measuring equipment are described.

N-23775*

ON EXACT SOLUTIONS OF THE STOKES-NAVIER EQUATIONS OF INCOMPRESSIBLE FLUIDS AT MODIFIED BOUNDARY CONDITIONS. (Über exakte Lösungen der Stokes-Navier-Gleichungen inkompressibler Flüssigkeiten bei veränderten Grenzbedingungen). Jakob Ackeret. September 1954. 20p. diags. (Trans. from Zeitschrift für angewandte Mathematik und Physik, v. 3, no. 4, 1952, p. 259-271)

There exist solutions of the hydrodynamic equations if the boundary conditions are modified. If it can be arranged that the "solid" boundaries are actually moving with the fluid velocity then really simple solutions are obtained. Several examples are worked out. As turbulence is unlikely to occur under these conditions, the power to move bodies in a viscous

fluid at high Reynolds numbers would become extremely low. It seems that even a partial fulfillment of these changed conditions would be of practical interest.

DECLASSIFIED NACA REPORTS

NACA RM L9B10

AN ANALYSIS OF AVAILABLE DATA ON EFFECTS OF WING-FUSELAGE-TAIL AND WING-NACELLE INTERFERENCE ON THE DISTRIBUTION OF THE AIR LOAD AMONG COMPONENTS OF AIRPLANES. Bertram C. Wollner. April 11, 1949. 33p. diags., tab. (NACA RM L9B10) (Declassified from Confidential, 8/18/54)

Available information on the effects of wing-fuselage-tail and wing-nacelle interference on the distribution of the air load among components of airplanes is analyzed. The effects of several variables are considered. Of these, vertical wing position is found to affect the change in lift caused by interference between wing and fuselage to the greatest extent.